IN THE SPECIFICATION

Page 1, line 1:

CONTROL OF IMAGE FORMING SECTIONS OF A

PRINTING APPARATUS WITH COLOR REGISTRATION

Paragraphs starting at page 4, line 25:

Referring to Fig. 1, four image forming sections 2K, 2Y, 2M, and 2C (hereinafter also referred to generally, or as a group, by reference numeral 2) are aligned along a transport path of a print medium. The image forming sections 2K, 2Y, 2M, and 2C are printing mechanisms that form images of black, yellow, magenta, and cyan respectively.

Each of the image forming sections respectively has a photoconductive drum 6, a charging roller 7 (referring generally to the group including charging rollers7C, 7M, 7Y, and 7K), an LED head 3, a developing unit 9, and a cleaning unit that scrapes off residual toner on the photoconductive drum 6. LED heads 3K, 3Y, 3M, and 3C (above, and hereinafter, also referred to generally, or as a group, by reference numeral 3) illuminate the surfaces of photoconductive drums 6K, 6Y, 6M, and 6C (above, and hereinafter, also referred to generally, or as a group, by reference numeral 6) to form electrostatic latent images of the corresponding colors and then developing rollers develop the electrostatic latent images with toners of the corresponding colors, thereby forming toner images of the respective colors. The toner images of the respective colors are transferred by corresponding transfer rollers 4K, 4Y, 4M, and 4C (hereinafter also referred to generally, or as a group, by reference numeral 4) onto a print medium.

The developing units 9K, 9Y, 9M, and 9C (above, and hereinafter, also referred to generally, or as a group, by reference numeral 9) are detachably attached to the image forming sections 2K, 2Y, 2M, and 2C, respectively, which are individually driven by corresponding motors.

Paragraph starting at page 7, line 11:

Likewise, the LED heads 3M, 3C, and 3K receive image signals for magenta, cyan, and black, respectively, so that magenta, cyan, and black toner images are formed just as in the LED head for yellow. The residual toner from the photoconductive drum 6Y is scraped off by the cleaning unit 15Y (one of the cleaning units 15C, 15M, 15K, and 15Y, referred to generally by reference numeral 15) and collected by a screw shaft, not shown, into a waste toner reservoir, not shown, located outside of the printing mechanism.

Paragraphs starting at page 8, line 1:

The paper feeding mechanism will now be described. Referring to Fig. 1, the color printer 1 includes a paper feeding mechanism disposed at a right lower corner. The paper feeding mechanism includes a paper cassette 41, a hopping mechanism [[47,]] 40 and registry rollers 51 and 52. The ~~paper cassette 40 includes a~~ paper cassette 41 [[,]] includes a push-up plate 42, and an urging member 43. The hopping mechanism [[47]] 40 includes a separator 44, a spring 45, and a feed roller 46 and is located at a paper outlet of the paper cassette 41. The hopping mechanism [[47]] 40 picks up a sheet of paper S to feed it into guides 48 and 49 through which the paper S is fed to a first registry roller 51 and a second registry roller 52 that are in pressure contact with a transport roller 50.

An attraction roller 54 is in pressure contact with the driven roller 31, causing the paper S, advanced by the hopping mechanism [[47]] 40 to a paper guide 53, to be charged so that the paper S is electrostatically attracted to the transport belt 20. The attraction roller 54 is formed of a high resistance, electrically semiconductive rubber material. Disposed between the attraction roller 54 and the image forming section for yellow is a photo sensor 55 that detects the leading edge of the paper S. The paper S may be advanced without having to employ the attraction roller 54.

Paragraph spanning pages 9-10:

The controller 70 includes a microprocessor, ROM, RAM, timer, and I/O, and controls the overall operation of the color printer 1 in Fig. 1. The controller 70 is connected to an SP bias power supply 71, a DB bias power supply 72, a charging power supply 73, and a transferring power supply 74. The SP bias power supply 71 supplies electric power to the toner-supplying roller 27b in the form of an electrically conductive sponge roller. The DB bias power supply 72 supplies electric power to the developing rollers 27a. The charging power supply 73 supplies electric power to the charging roller 7. The transferring power supply supplies electric power to the transfer rollers 4C, 4M, 4Y, and 4K. The output voltages of the power supplies 71-74 are supplied to the printing mechanisms for yellow, magenta, cyan, and black, being switched on and off for individual colors.

Paragraph starting at page 10, line 32:

The fixing unit control circuit 80 drives a heater, not shown, in the heat roller 64 in the fixing unit 63 so as to maintain the heat roller 64 at a predetermined temperature. The motor drive circuit 81 is connected to motors ~~82-85 and motors 87~~ 82-89. The motors 82-85 drive the corresponding transfer rollers of the image forming sections 2K, 2Y, 2M, and 2C, respectively. The motor 87 drives the feed roller 46 and the transport roller 50. The motor 88 drives the fixing unit 63. The motor 89 causes the developing unit 2 to move into and out of contact engagement with the photoconductive drum 6. The motors 82-89 are coupled via gears and belt, not shown, to corresponding driven elements.

Paragraph starting at page 13, line 10:

When the heat roller 64 reaches a predetermined temperature, the controller 70 causes the motor drive circuit 81 to drive the motor 87, thereby driving the drive roller 30 in rotation so that

the transport belt 20 runs in a direction shown by arrow E. As a result, the cleaning blade 33 scrapes the residual toner and dust deposited on the surface of the transport belt 20 into the waste toner tank 34. When the transport belt 20 runs over a distance slightly longer than its one complete rotation, the motor 87 is stopped, thereby completing a cleaning operation. During the cleaning operation, the motors 82, 83, 84, and 85 in the printing mechanisms K, Y, M, and C are rotated, and the controller 70 causes the DB bias power supply 72, charging power supply 73, and SP bias power supply 71 to turn on for printing images of the respective colors. Thus, the predetermined voltages are applied to the charging roller 7, developing roller 27a, and the toner-supplying roller 27b, respectively. The cleaning blade 15C, 15M, 15Y, and 15K scrapes the residual toner from the photoconductive drum 6, thereby completing the cleaning operation.

Paragraph starting at page 15, line 7:

Upon receiving the storage completion signal from the I/F control circuit 111, the data converting circuit 113 converts the RGB data into the Y-, M-, C-, and K data. In other words, the data converting circuit 113 receives the RGB data on a line-by-line basis from the buffer memory 112b and converts the RGB data into the Y-, M-, C-, and K data, which will be stored into the buffer memory 114 subsequently. Just as the buffer 112, the buffer memory 114 includes a data storage area 114a in which data for the respective colors is stored and a command storage area 114b in which commands are stored. The buffer 112 has start addresses for the RGB data of respective colors. The data converting circuit 113 generates addresses of areas corresponding to the respective colors from the start addresses to read the RGB data from the buffer 112 on a line-by-line basis, while at the same time generating addresses of areas corresponding to the respective colors from the start addresses to store the Y-, M-, C-, and K data into the data storage area 114a of the buffer 114 on a line-by-line basis.

Paragraph starting at page 17, line 1:

The controller 70 causes the motor drive circuit 81 to drive a corresponding one of the motors 81-88, thereby rotating the photoconductive drum 6 in the corresponding image forming section 2, charging roller 7, developing roller and sponge roller in developing unit 2, transfer roller 4C, 4M, 4Y and 4K, drive roller 30, ~~transfer~~ transport roller 50, and heat roller 64 of the fixing unit 63. At the same time, the controller 70 turns on the charging power supply 73, developing bias power supply 72, and SP bias power supply 71 to supply voltages to the charging roller 7, DB roller 27a, and SB roller 27b of a corresponding image forming section 2. Thus, the surfaces of the photoconductive drums of corresponding image-forming sections 2 are uniformly charged by corresponding charging rollers 7. The DB rollers 27a and SB rollers 27b are also charged to predetermined high voltages.

Paragraph starting at page 18, line 14:

Thereafter, when the leading edge of the paper S reaches between the photoconductive drum 6 and transfer roller 4C, 4M, 4Y and 4K, the controller 70 turns on the transfer power supply [[13]] 74 so that the toner image on the photoconductive drum 6 is electrostatically transferred by the transfer roller 4 onto the paper S. As the photoconductive drum 6 rotates, the toner image for one page is transferred onto the paper S. This completes the transfer of a toner image of a specified color onto the paper S.

Paragraphs starting at page 22, line 22:

In addition, a transfer voltage is applied to the transfer roller 4C, 4M, 4Y and 4K corresponding to the image forming section 2C, 2M, 2Y and 2K that is not attached to the printer, thereby minimizing leakage of current occurring when the paper S passes between

adjacent the image forming sections 2C, 2M, 2Y and 2K. Thus, printing quality can be as good as when all the image forming sections are attached.

In the second embodiment, when the image forming section 2C, 2M, 2Y and 2K absent from the printer is specified, the error handling operation is carried out. This allows the operator to check the problem before printing, preventing failure of printing.

When it is determined that image forming sections specified by the operator have not been attached to the printer 1, a message may be displayed which indicates to the operator that desired image forming sections 2C, 2M, 2Y and 2K are not attached. Of course, an exclusive sensor may be provided in order to detect the presence and absence of the image forming sections. However, the remaining toner sensor 97 may be conveniently used to detect the presence and absence of the image forming sections in the printer 1, thereby eliminating the need for a separate sensor.

Paragraph starting at page 23, line 16:

Just as in the first embodiment, upon completion of initialization of the color printer 1, the printer 1 waits for image data, which will be sent from the host apparatus through the interface [[79]] 111. The operator specifies image-forming sections to be operated through the operation panel 91 in Fig. 7. During initialization, the remaining toner sensor 97 (Fig. 10) sends information on a corresponding image forming section. That is, remaining sensors send information representing that each of the image forming sections 2K, 2M, and 2C for black, magenta, and cyan have been attached to the printer 1. The information on an image forming section to be used is sent from the operation panel 91 to the controller 70, which in turn stores the information into the internal memory therein.

Paragraph starting at page 24, line 4:

The controller 70 determines image forming sections to be operated based on the information stored in the internal memory of the controller 70, (i.e., image forming sections of specified colors) and the information from the remaining toner sensor 97. The controller 70 causes the image forming sections of the specified colors to operate, the image forming sections having been detected by the corresponding remaining toner sensors 97. In this case, the controller 70 causes the image forming section 2K of black to operate. Also, the controller 70 ~~causes image-forming sections not to be~~ allows operation of the image-forming section not specified but detected by the remaining toner sensors 97. That is, if image data for the image forming sections of magenta, and cyan exist, the controller 70 allows these image-forming sections 2M and 2C to print.

Paragraph starting at page 24, line 17:

In the third embodiment, printing is not performed for an image forming section specified but not detected by the corresponding remaining toner sensor 97. For image forming sections not specified but detected by the corresponding remaining toner sensor 97, the image data is not sent to the printer unit 120 and the motor for that image forming section is not driven. Moreover, the image forming section is moved away from the transport belt 20. If an image forming section is not detected, a transfer voltage is applied to the transfer roller for the image forming section 2C, 2M, 2Y and 2K so as to prevent leakage current.

Paragraph starting at page 25, line 8:

Just as in the second embodiment, when the initialization of the color printer 1 completes, the controller 70 waits for image data, which will be received from an external host apparatus through the interface [[79]] 111. The operator specifies an image forming section to be used via

the operation panel 91 in Fig. 7. During initialization, the remaining toner sensor 97 in Fig. 10 transmits the information on an image forming section not attached to the printer 1 to the controller 70.

Paragraph starting at page 25, line 20:

When the control unit 110 [[79]] receives image data from the host computer, the controller 70 outputs commands for separating the image data into the respective colors to the control unit 110 and the respective memory areas of the image memory 78. That is, the data converting circuit 113 in Fig. 8 converts RGB data into YMCK data. In response to the command from the controller 70, the data converting circuit 113 selects image data to be further processed based on the information on the image forming sections to be used and information from the remaining toner sensor 97.